the brown spot must be the satellite itself, and, as I can find no record of a similar previous observation, I venture to forward this note, hoping that others with ampler opportunities will tell us more of a deeply interesting if not unique phenomenon.

Llanelly:
1892 *March* 11.

Notes on the Spectrum of the Great Sun-Spot Group of 1892 *February.* By Prof. K. D. Naegamvala, M.A.

While examining the large spot group, which made its appearance on the Sun's disc early last month, for the widened lines in the region *b* to F, on the 12th of the month, I found that, besides an unusual thickening of the lines both in intensity and number, the F and C lines were reversed at the centres of the two chief nuclei of the group. The absorption was so intense that the lines were frequently obliterated in the nuclei, and I had to displace the nuclei from the slit and observe the widenings in the neighbouring portions of the spot.

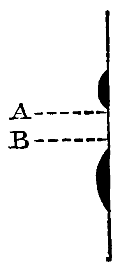
While repeating the observations on the morning of the next day, at about 10.30 Madras mean time (5.10 A.M. G.M.T. nearly), with the slit crossing both the nuclei, it was found that the reversed lines of the day previous had greatly increased in intensity. During observation, the C line gradually extended from one nucleus to another, and was displaced towards the more refrangible side by about its own thickness. The F line was also similarly affected, but with it the displacement was greatest in the space *midway between* the two nuclei. Subsequently, when the slit was placed slightly off the centre of the preceding nucleus (A) with the fine motion in declination, a small *dark* prominence was observed on the F line towards the less refrangible side, a little preceding A, and tipped downwards in the spectroscope towards the spot. On bringing the spot (A) again on the slit it was found that the F line in the spot had assumed a lozenge shape and was also deflected towards the more refrangible side by a distance estimated to be equal to the thickness of the F line. To make myself certain of the existence of the dark prominence, the spectrum was adjusted for the C line, when the black prominence was again observed, but the tip was now deflected away from the spot. That the appearance was not due to any defect or flaw in the instrument was evident from the fact that the appearance was not presented in any other part of the spectrum examined (C to F), except on the two H lines.

Besides the lines C and F, the lines D_1 D_2 D_3 b_1 b_2 b_3 b_4 were found reversed, and on pointing the observing telescope to the region near G it was ascertained to be similarly affected.

The *b* lines, though found reversed, were not observed

bright in the *same* region of either of the two nuclei, and the two centres of the spot had to be slightly shifted in the slit to successively observe the reversals of the four *bs*. The uprushes, therefore, of the elements represented by these lines were evidently of a more restricted character than those of hydrogen and sodium.

D_3 was very bright in both the nuclei, but did not extend from nucleus to nucleus like the hydrogen lines. On the other sides of both the nuclei, however, the helium line extended in continuation of the bright ones, though situated slightly towards the red end. On the side of the preceding nucleus (A) it extended to a distance of about six times the length of the reversed D_3 in the nucleus, and on the side of the nucleus following (B) it was observed to a distance equal to about four times the length of the reversed line in that nucleus. These absorption helium lines were not of uniform thickness and intensity, and they gradually disappeared on the background of the spectrum. The space between A and B was also subsequently found to be crossed by the absorption line of D_3, but there it was much less in intensity than beyond the spot centres. A short while after, the spots were put off the slit by a slight motion in declination, when almost throughout the whole



region of the spot-group the dark D_3 was observed flashing out, rather fuzzy in appearance and broadened as indicated on the less refrangible side, but in regions beyond A and B. At no time did the bright D_3 cross from spot to spot as did the H lines.

Other duties obliged me to postpone observing at about 12.30, Madras mean time, but three hours afterwards (about 10 A.M. G.M.T.), when I resumed observing, the disturbance had almost died away. D_3 was completely absent from both the spots, either as an absorption or emission line, and the only line then positively seen to be reversed was C in nucleus A, while the reversal of F was also suspected. On the other hand, the spectrum of nucleus B was normal in appearance.

On writing to the Director of the Colaba Magnetic Observatory, I was informed that "one of the largest magnetic storms of recent years occurred here (at Bombay) between 10 A.M. (local time ?) of the 13th, and 10 A.M. of the 14th inst. It

continued in moderated intensity for the next twelve hours, and then gradually died away."

The spectroscope employed had a dispersion of three flint prisms of 60° once reversed, with collimator and spectroscope of 1″ aperture, magnifying fifteen diameters. The dispersion obtained showed many more lines than in Angström's Spectre Normal.

The Mahárajah Takhtasingjee (of Bhavnagar) Observatory, College of Science, Poona:
1892 *March* 11.

On the Estimation of Star Magnitudes by Extinction with the Wedge. By Capt. W. de W. Abney, C.B., D.C.L., F.R.S.

Some experiments which I have recently made, and communicated to the Royal Society in a paper by Gen. Festing and myself, Colour Photometry, part III., have a direct bearing on the estimation of star magnitudes by the wedge, and it has seemed advisable to put on record in what way this occurs.

Amongst other matters, the question arose as to the amount by which the intensity of any ray of the spectrum would have to be reduced before it became invisible. Of course the comparative luminosity of the spectrum had to be known at the various parts, and when the absolute luminosity in candle power of any one ray was known, the others could be calculated. In the experiments in question, the spectrum used was that formed by the positive pole of the electric light, and the comparative luminosities were measured, as also the absolute intensity of the light at D coming through a slit placed in the spectrum. This light was spread out into a square patch by a suitable optical arrangement so as to fall on the end of a darkened box, where a black screen with a white disc received it. The light was gradually diminished until the eye which observed through a small aperture in the box could no longer distinguish the white disc. Measures taken in this way showed that if the D light were reduced to $\frac{350}{10,000,000}$ of a standard amyl lamp (which in future for shortness I will call A L) the illumination was so feeble that the white disc could no longer be seen, and no scintilla of light was visible to the eye. The green E light had to be reduced to $\frac{65}{10,000,000}$, the F light to $\frac{150}{10,000,000}$, the G light to $\frac{3,000}{10,000,000}$, whilst the red light at C had only to be reduced to $\frac{110,000}{10,000,000}$ before the screen was invisible. These are the numbers when the D light in the